

REMARKS

The foregoing amendment amends independent claims 1, 15, 48 and 19. Pending in the application are claims 1-22, 24-41, 48 and 49, of which claims 1, 15, 48 and 49 are independent. The following comments address all stated grounds for rejection and place the presently pending claims, as identified above, in condition for allowance.

Independent claims 1, 15, 48 and 49 are amended to change the phrase “such that none of the liquid enters the fluid interface port” to ---such that none of the liquid in the microchannel enters the fluid interface port when the virtual wall is formed---. The amendment clarifies that the virtual wall has zero dead volume, i.e., the virtual wall capillary forces prevent liquid in the microchannel from entering the fluid interface port, as set forth on page 21, lines 9-18 of the application as originally filed.

Claims 15 and 48 are amended for purposes of clarity to remove the phrase “wherein said microchannel includes a side wall,” and to change the word “side wall” to ---cover---in line 16 of claim 15 and in line 15 of claim 48. *No new matter is added.*

Amendment and/or cancellation of the claims is not to be construed as an acquiescence to any of the objections/rejections set forth in the instant Office Action, and was done solely to expedite prosecution of the application. Applicant reserves the right to pursue the claims as originally filed, or similar claims, in this or one or more subsequent patent applications.

Double Patenting Rejection

Claims 1-22 and 24-41 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-28 and 58-150 of copending Application No. 10/028,852 as characterized by US 2003/0007898 and claims 1-45 of copending Application No. 10/057,354. Applicants submit that the claims are patentably distinct from the claims of co-pending U.S. Patent Application Nos. 10/028,852 and 10/057,354. If necessary, Applicants will file a Terminal Disclaimer upon resolution of all other outstanding issues.

In addition, the Examiner rejects claims 1-22 and 24-41 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-26 of U.S. Patent Number 6,877,528. The claims in the present application are entirely different from the claims in U.S. Patent Number 6,877,528, as previously set forth. However, to expedite prosecution, Applicants will file a Terminal Disclaimer upon resolution of all other outstanding issues.

35 U.S.C. §112 Rejection

In the Office Action, the Examiner rejects claims 1-22, 24-41 and 48-49 under 35 USC §112, first paragraph, as failing to comply with the written description requirement. Applicants submit that the subject matter of the claims is sufficiently described in the specification as originally filed, and request that the rejection under 35 USC §112, first paragraph be reconsidered and withdrawn.

Regarding the assertion that the specification does not teach the claimed diameter of the port being less than the diameter of the microchannel, Applicants submit that Figure 2A clearly shows the diameter of the port as less than the diameter of the microchannel. In addition, page 21, lines 4-5 specifically describe the “lateral dimensions of the fluid interface port” as “less than the diameter of the microchannel 3.” Therefore, the recitation is sufficiently supported.

Regarding the assertion that the specification does not teach “none of the liquid entering the fluid interface port”, Applicants submit that adequate support is found in the specification. A fluid interface port in which none of the liquid from the microchannel entering the fluid interface port is shown in Figure 9A and described on page 21, lines 4-28. In Figure 9A, the fluid interface port has “zero dead volume i.e. no liquid is retained in the fluid interface port 17”. In addition, page 9, lines 7-10 specify that the aperture forming the fluid interface port “has suitable cross sectional dimensions such that capillary forces retain liquid within the microchannel. The virtual wall is defined by the meniscus of the liquid in the opening, which essentially replaces the side wall of the microchannel so as to not substantially affect or influence fluid flow through the microchannel.” Therefore, the recitation of no liquid from a microchannel entering a fluid interface port when the virtual wall is formed is sufficiently supported in the original specification.

For at least these reasons, Applicants request reconsideration and withdrawal of the 35 U.S.C. §112 Rejection.

Claim Rejections Under 35 USC §102

In the Office Action, the Examiner maintains and finalizes the rejection of claims 1-22, 24-41 and 48-49 under 35 U.S.C. 102(e) as being anticipated by the Chow reference (U.S. Patent Number 6,494,230), claims 1-22, 24-41 and 48-49 under 35 U.S.C. 102(b) as being anticipated by the Handique reference (U.S. Patent Number 6,130,098), and claims 1-22, 24-41 and 48-49 under 35 U.S.C. 102(b) as being anticipated by the Fuchs reference (U.S. Patent Number 5,757,482). Applicants submit that the pending claims distinguish patentably over the cited references, and request reconsideration and allowance of the pending claims.

Independent claims 1, 15, 48 and 49 specify that none of the liquid in a microchannel enters into the fluid interface port when the virtual wall is formed upon filling of the microchannel. The filling of the microchannel creates the virtual wall meniscus at the fluid interface port, which replaces a removed portion of a side wall of the microchannel, a feature not disclosed in the cited references. The virtual wall essentially seals the fluid interface port, preventing liquid that fills the microchannel from entering the fluid interface port and resulting in a direct fluid interface with zero dead volume, in contrast to the cited references.

In addition, Applicants maintain that the cited references, alone or in combination, do not disclose a device having a fluid interface port with a constant depth that is substantially smaller than the diameter of the fluid interface port, as recited in independent claims 1 and 15. The recited fluid interface ports thus have a disk shape, as shown in Figures 2A and 2B, and described on page 17, lines 19-20, to facilitate *direct* access to the channel interior, a feature not taught or suggested in the cited references. The disk-shape provides significant advantages, such as direct access to the microchannel interior, low dead volume and greater injection efficiency.

The Chow reference does not disclose a fluid interface port that is free from liquid, as required by the claimed invention. In contrast to the claimed invention, the Chow reference

discloses ports specifically designed to retain liquid therein. The Chow reference includes ports 126, 128, 130, 132, that are extremely *large* relative to the associated channels 124. The ports 126 and 128 in Chow are clearly larger in diameter than the associated microchannel, in contrast to the claimed invention. These ports will naturally fill at least partially with liquid when added to the system, in contrast to the claimed invention, where liquid is prevented from entering the port when an associated microchannel is filled with liquid. In fact, the Chow reference requires that the fluid introduction ports 126, 128, 130 and 132 be relatively large. For example, Chow specifies that “the ports described above will generally range from about 0.5 mm to about 10 mm, and preferably from about 1 mm to about 5 mm, the fluid passages disposed through the substrates on the other hand, will typically range from about 30 um to about 500 um in diameter” (see column 10, lines 40-47). In addition, Chow specifies that the “type of port structure is described in substantial detail in commonly owned U.S. Pat. No. 6,090,251” which illustrates ports 34 that are substantially filled with liquid 50, with the liquid held in the port 34 by capillary force, in clear contrast to the claimed invention. (See Figure 3 of U.S. Patent Number 6,090,251 below) Therefore, Chow not only fails to anticipate the claimed invention, Chow in fact teaches *away* from the claimed invention.

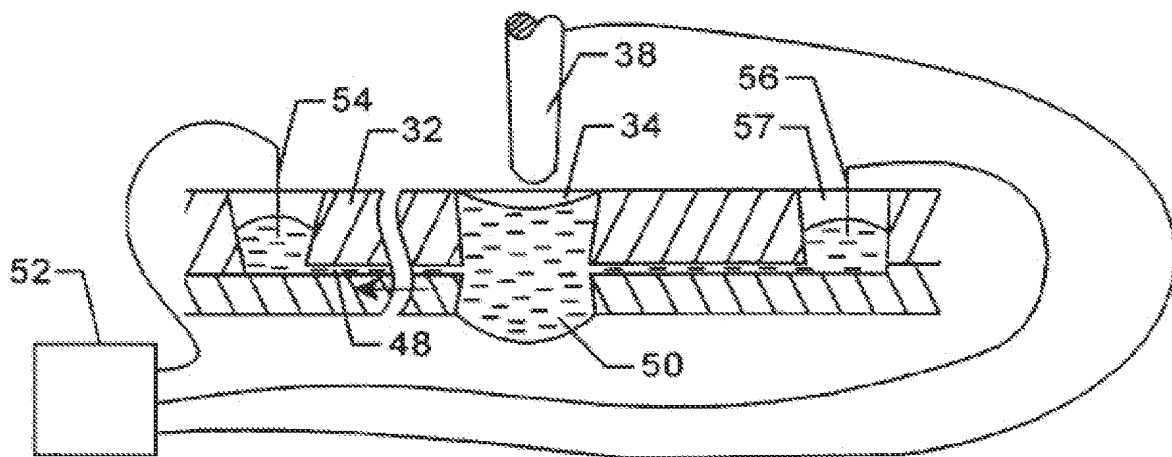


Fig. 3

Regarding the rejection in view of the Handique reference, the Handique reference clearly illustrates liquid *filling* the ports 20 and 30, resulting in a large dead volume, in contrast with the claimed invention, which requires the fluid interface ports to be free of liquid. In addition, the entry port (A) in Handique has a cross-section diameter greater than the diameter of the channel, in contrast to the claimed invention. The vent 70 in Handique also forms a channel having a depth that is significantly *larger* than the cross-section of the channel, in contrast to the claimed invention. The vent 70 is also incapable of positioning a meniscus in a co-planar location with a side wall. Rather, any meniscus formed in the vent 70 of Handique will align only with a small portion of a side wall, in contrast to the claimed invention. In addition, the vent 70 clearly affects the flow of fluid in the associated channel, which teaches away from the claimed virtual wall, which does not at all affect the flow of fluid and merely replaces a removed portion of the side wall.

The Fuchs reference also fails to disclose, and in fact teaches away from a fluid interface port that is free from liquid. In Fuchs, the cross-sectional diameter of the port 24 is significantly *larger* than the channels 12 and 16 in contrast to the claimed invention, which causes liquid in an associated channel 12 and 16 to fill the port 24. In addition, the Fuchs reference discloses that the port 24 is formed in the cover 12, which is at least 400 microns thick, as set forth in column 5, lines 12-14. Therefore, even *if* the depth of the port 24 *was* significantly smaller than the diameter of the port, the port diameter would be required to be several times the recited range of between about 25 μm and about 100 μm .

Each of the prior references fails to disclose a microchannel filled with liquid and having a virtual wall fluid interface port in which such that none of the liquid in the microchannel enters the fluid interface port when the virtual wall is formed, as recited in the claims.

For at least these reasons, and for the reasons submitted in previous responses, Applicants respectfully submit that all pending examined claims are patentable, and request that the objections and rejections be reconsidered and withdrawn.

CONCLUSION

In view of the above amendment, applicants believe the pending application is in condition for allowance.

If any fee is due, please charge our Deposit Account No. 12-0080, under Order No. TGZ-001CRCE5 from which the undersigned is authorized to draw.

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Respectfully submitted,

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